rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of U.S. Patent No. 4,588,490 to Cuomo et al. (hereinafter "Cuomo et al."). Claims 13, 19, 20 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of Cuomo et al., and further in view of U.S. Patent No. 5,876,573 to Moslehi et al. (hereinafter "Moslehi et al."). Claim 25 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of Cuomo et al., and further in view of U.S. Patent No. 5,556,519 to Teer (hereinafter "Teer"). Claim 26 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of Cuomo et al., and further in view of U.S. Patent No. 5,482,611 to Helmer et al. (hereinafter "Helmer et al"). Applicants have carefully considered these rejections and the cited references, and traverse the rejections for reasons set forth below.

Claim 42 is allowed. Claims 15 – 17, 27, 31 – 34, 36 – 41 and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

Election/Restriction

In the present application, a restriction has been made resulting in Group I consisting of claims 1 – 45 and Group II consisting of claims 46 – 54. Applicants hereby affirm the election made with traverse during a telephone conversation occurring on February 27, 2003 to prosecute Group I, claims 1 – 45. As a primary basis for the traversal, it is believed that, because Groups I and II are related as process of making and product made, a search and examination of non-elected Group II would not be burdensome to the U.S. Patent and Trademark Office. In particular, it is believed that prior art references relevant to Group II would likely overlap with the prior art references relevant to Group I. Therefore, applicants respectively request that the restriction be withdrawn.

Claim Rejections – 35 U.S.C. § 102

The Examiner rejects claims 1, 2, 4, 6, 7, 9, 14, 18, 22, 24, 43 and 44 under 35 U.S.C. § 102(b) as being anticipated by Mikalesen et al. Applicants traverse this rejection because Mikalesen et al. fails to teach each and every element recited in the rejected claims.

Independent claim 1 is directed to a "sputter transport device". Claim 1 recites a "non-thermionic . . . injector assembly". Mikalesen et al. fail to teach a non-thermionic injector assembly. To the contrary, Mikalesen et al. teach only a thermionic injector assembly.

The term "thermionic" generally relates to electrons emitted from materials at high temperatures. In a thermionic device, the high operating temperature is the catalyst for emitting electrons, i.e., electrons are not emitted until these high temperatures are reached. Devices such as those disclosed by Mikalesen et al. and Cuomo et al. operate at high temperatures such as 2000 K, using refractory materials that are suited for operation at these high temperatures. See, for example, Cuomo et al. at column 3 lines 9 – 15 (discussing thermionic emission of electrons at 2000 K). By contrast, the device claimed in claim 1 is a non-thermionic device in which high temperatures are not required for the emission of electrons. The non-thermionic device claimed in claim 1 is designed to operate at low temperatures that are far below the temperatures required for thermionic emission. This allows the materials to be used for constructing the device to be low melting point materials such as aluminum or copper if desired. Such materials would never survive, much less operate at, a temperature of 2000 K. This enables any type of material to be used in designing the non-thermionic injector in claim 1, which is a novel advantage over the prior art. Moreover, with the non-thermionic device claimed in claim 1, the injector can be made from the same material as the sputter cathode material as claimed for example in claim 27. This provides a non-contaminated method of enhancing the sputtering process. This is not possible with the conventional thermionic hollow cathode device disclosed in either

Mikalesen et al. or Cuomo et al., in which only refractory metals capable of withstanding thermionic emission-initiating temperatures can be used at the electron emitter.

Without limiting the scope of any of the rejected claims in any manner, an explanation of the ability of the claimed sputter transport device to provide non-thermionic emission is proposed as follows. A negative voltage is applied to the injector assembly, causing electrons to be ejected from inside surfaces thereof. The electrons become trapped within the injector assembly, and strike gas molecules to form a plasma inside the injector assembly. An avalanche effect generates a high density of electrons and ions within the injector assembly. The generation of plasma creates heat, due to electron-ion bombardment, but the temperature can be kept low due to the mass of the assembly and/or the use of a suitable cooling system. The electrons are then drawn out of the injector assembly by the presence of the magnetic field associated with the magnetron assembly, thus enhancing the sputtering process occurring at the magnetron target surface.

It will be noted that Cuomo et al. is an example of previous work by one of the named inventors in the present application, Dr. Jerome J. Cuomo. Both Cuomo et al. and Mikalesen et al. have a common assignee, International Business Machines Corporation, Armonk, N.Y. It is believed that the subject matter disclosed in Mikalesen et al. is an extension of the previous work disclosed in Cuomo et al. in which a specific collimator structure has been added. The present invention as claimed in the rejected claims is considered by applicants to be an improvement over the previous work of Dr. Cuomo disclosed in Cuomo et al. and the subject matter disclosed in Mikalesen et al. In the present application, at pages 13 – 14, applicants specifically distinguish Cuomo et al. by discussing drawbacks associated with the use of thermionic emitting electron devices, including problems associated with contamination and the intense heat produced by thermionic emission. At pages 15 – 16 of the present application, applicants note that the non-thermionic device has the

advantage of the cooler operating temperature as compared with a thermionic hollow cathode configuration, thereby allowing the injector assembly to be composed of low-temperature materials. On page 17 of the present application, applicants note that the non-thermionic device is able to increase plasma density without the contamination problem associated with a traditional, thermionic-emitting tantalum tip. As stated on page 24 of the present application, lines 20 – 22, "[d]ue to the bulk mass and/or cooling design of injector assembly **150**, its temperature remains low and accordingly no thermionic emission, evaporation or contamination takes place during deposition". In summary, it is respectfully submitted that the sputter transport device comprising a non-thermionic injector assembly claimed in claim 1 is patentably distinct over any thermionic device such as disclosed in Mikalesen et al. and Cuomo et al.

Claims 2, 4, 6, 7, 9, 14, 18, 22 and 24 each depend ultimately from claim 1, and therefore are distinguishable for the same reasons as regards claim 1.

Independent claim 43 is directed to a "method for depositing a sputtered material at a high deposition rate". The method recites the step of "providing a . . . non-thermionic . . . injector assembly". Accordingly, claim 43 is distinguishable over the cited prior art references for the same reasons as regards claim 1 as set forth hereinabove.

Claim 44 depends from claim 43, and therefore is distinguishable for the same reasons. In view of the foregoing, applicants respectfully submit the claims 1, 2, 4, 6, 7, 9, 14, 18, 22, 24, 43 and 44 are patentable over Mikalesen et al. under 35 U.S.C. § 102(b), and respectfully request that the rejection to these claims be withdrawn.

Claim Rejections - 35 U.S.C. § 103

Claims 1 – 12, 14, 18, 22 – 24, 28 – 30, 35, 43 and 44 are rejected under 35 U.S.C. § 103 as being unpatentable over Mikalesen et al. in view of Cuomo et al. Claims 13, 19, 20 and 21 are rejected under 35 U.S.C. § 103(a) as being

unpatentable over Mikalesen et al. in view of Cuomo et al., and further in view of Moslehi et al. Claim 25 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of Cuomo et al., and further in view of Teer. Claim 26 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Mikalesen et al. in view of Cuomo et al. and further in view of Helmer et al. Applicants respectfully traverse these rejections because none of the proposed combinations teach, suggest or provide motivation for the invention as claimed in the claims corresponding to such rejections.

The deficiencies of Mikalesen et al. and Cuomo et al. are discussed hereinabove. Applicants arguments with respect to the rejections under 35 U.S.C. § 102(b) are equally applicable to the rejections made under 35 U.S.C. § 103(a). None of the additional references, Moslehi et al., Teer, or Helmer et al, discloses the non-thermionic feature of the rejected claims, nor suggests or provides motivation for non-thermionic emission. Moslehi et al. primarily teaches the use of a cooled magnetron assembly. Teer is also directed to magnetron assemblies. Helmer et al. is directed primarily to the combination of a magnetron and a hollow cathode open ended container that is itself the sputter target.

In view of the foregoing, applicants respectfully submit that claims 1 – 12, 14, 18, 22 – 24, 28 – 30, 35, 43 and 44 are patentable over the combined disclosures of Mikalesen et al. and Cuomo et al.; claims 13, 19, 20 and 21 are patentable over the additional disclosure of Moslehi et al.; claim 25 is patentable over the additional disclosure of Teer; and claim 26 is patentable over the additional disclosure of Helmer et al.; all under 35 U.S.C. § 103(a). Therefore, applicants respectfully request the Examiner to withdraw these rejections.

New Claims

New claims 55 – 73 have been added. New claims 55 – 73 are fully supported by the application as originally filed, and thus no new matter has been added.

New claims 55 – 60 all ultimately depend from allowed claim 42, and therefore are believed to be allowable at this time.

New claim 61 is an independent claim that includes the language of allowed claim 42, and therefore is believed to be allowable at this time.

New claims 62 – 73 all ultimately depend from claim 61, and therefore are believed to be allowable at this time.

CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that the present application is now in proper condition for allowance, and such action is earnestly solicited.

If any small matter should remain outstanding after the Patent Examiner has had an opportunity to review the above Remarks, the Patent Examiner is respectfully requested to telephone the undersigned patent attorney in order to resolve these matters and avoid the issuance of another Official Action.

DEPOSIT ACCOUNT

The Commissioner is hereby authorized to charge any fees associated with the filing of this correspondence to Deposit Account No. **50-0426**.

Respectfully submitted,

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